Light, Noise, APDs, and Electronics

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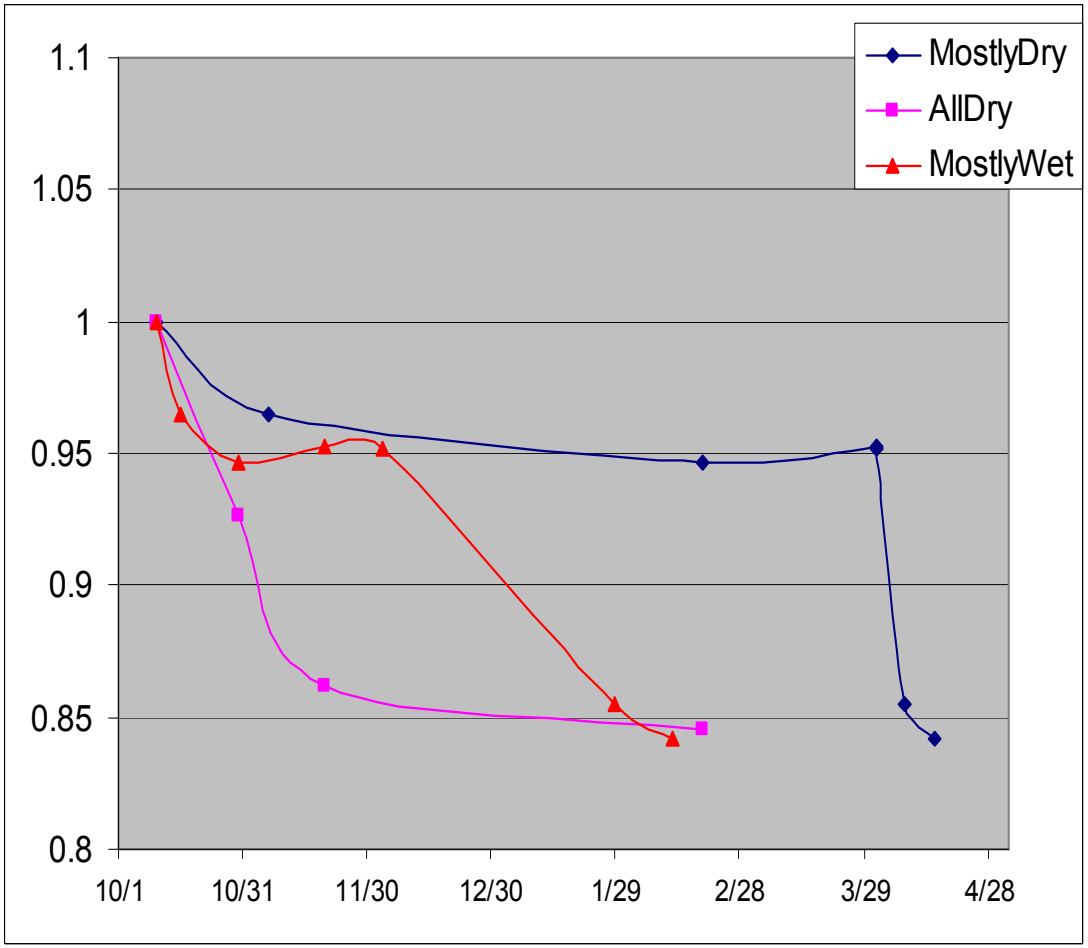
Light

- Tested 0.8mm fibers with loops of fiber 2.8cm in diameter. At least seven loops of fiber, equivalent to 14 "bottom end" loops.
- Periodically tested for attenuation
- First point of graphs is before looping.
- Initially ~5% change indicates 99.5% transmission
- Mostly this test underscores lessons learned from MINOS
- --Be careful handling fibers.
- Don't have fibers come out of a rigid connection without strain relief
- Shows upper limit of attenuation in loop ~1%

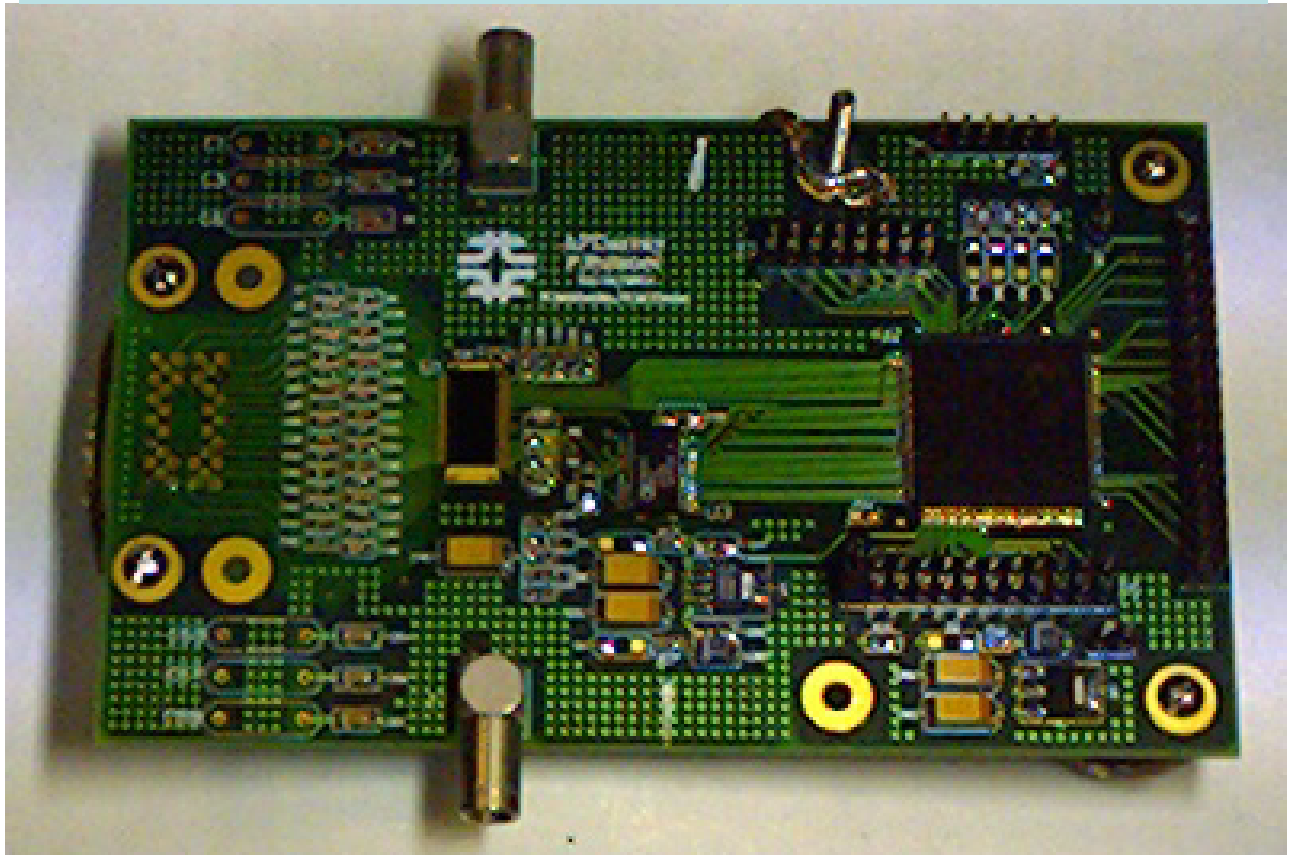


Current Activities

- Measure APD properties
  - Noise vs. T
  - Gain
  - Signal response
- No surprises
- Measure Noise in 3 more boards
  - Noise decreased to ~310e^- with new boards
- Measure Detector Properties:
  - Light output vs. Position (See KH VS talk)

New MASDA Prototype Board

- Improved noise performance
- Experience of version 1 incorporated:
  - Low noise voltage regulator
  - designed in additional filtering/bypassing



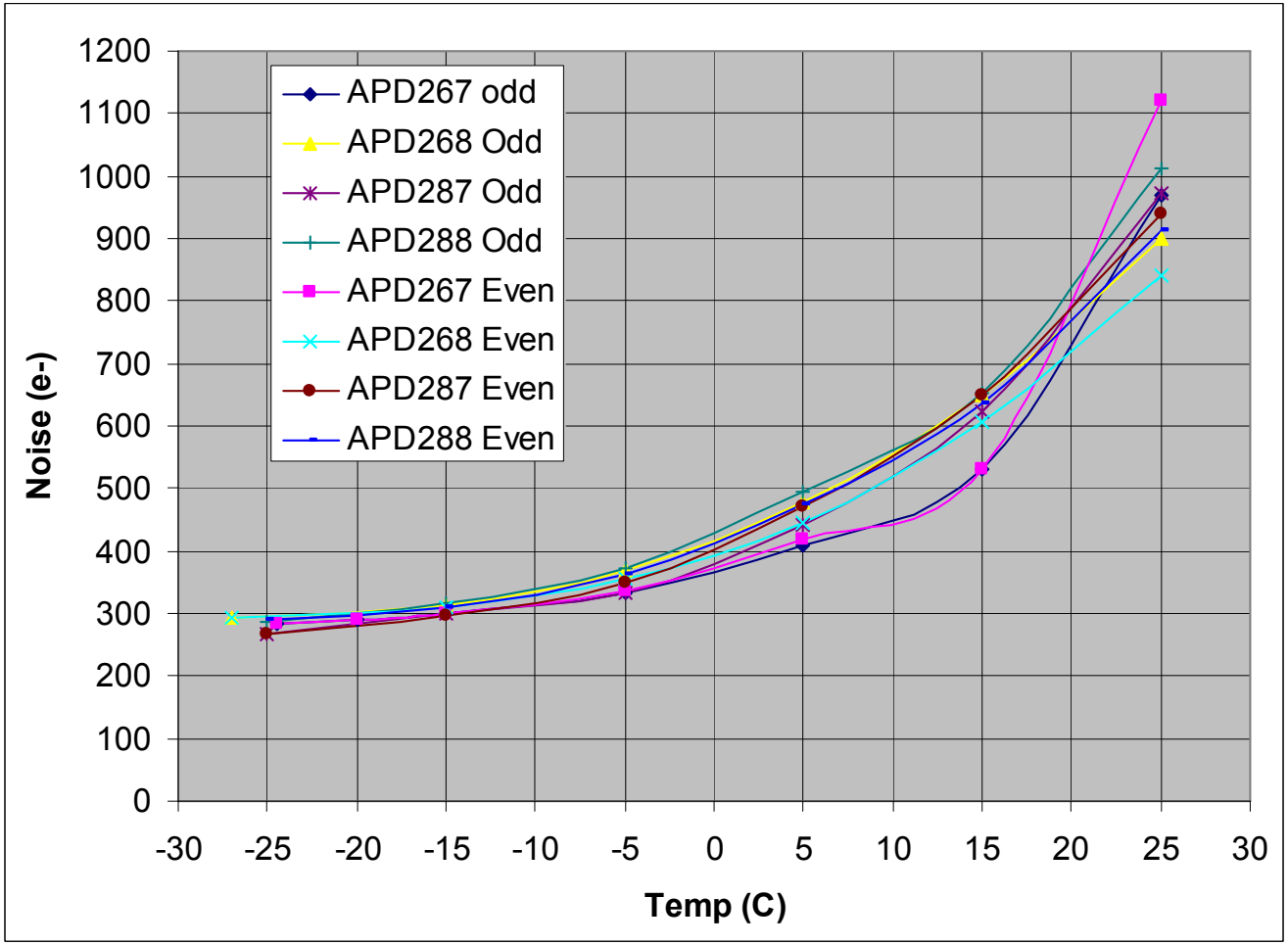
Improvements to Prototype boards

- Firmware re-written with two major corrections
  - Installed a triggered mode to work with external coincidence trigger – Air shower particles, or pulser
  - Reduced the noise by about 10% with a couple of fixes
    - Lengthen hold time for the “before” sample ~5%
    - Add multiple samples of MASDA analog output
      - Effectively averages out noise in the analog output to reduce noise by about 5%
  - Version 2 board reduced input capacitance (trace length)
  - Noise level at operating point of APD: M=100,T=-15C reduced to 315e^- from 360 reported previously.

Noise vs. T for 4 new boards

Four boards in use:

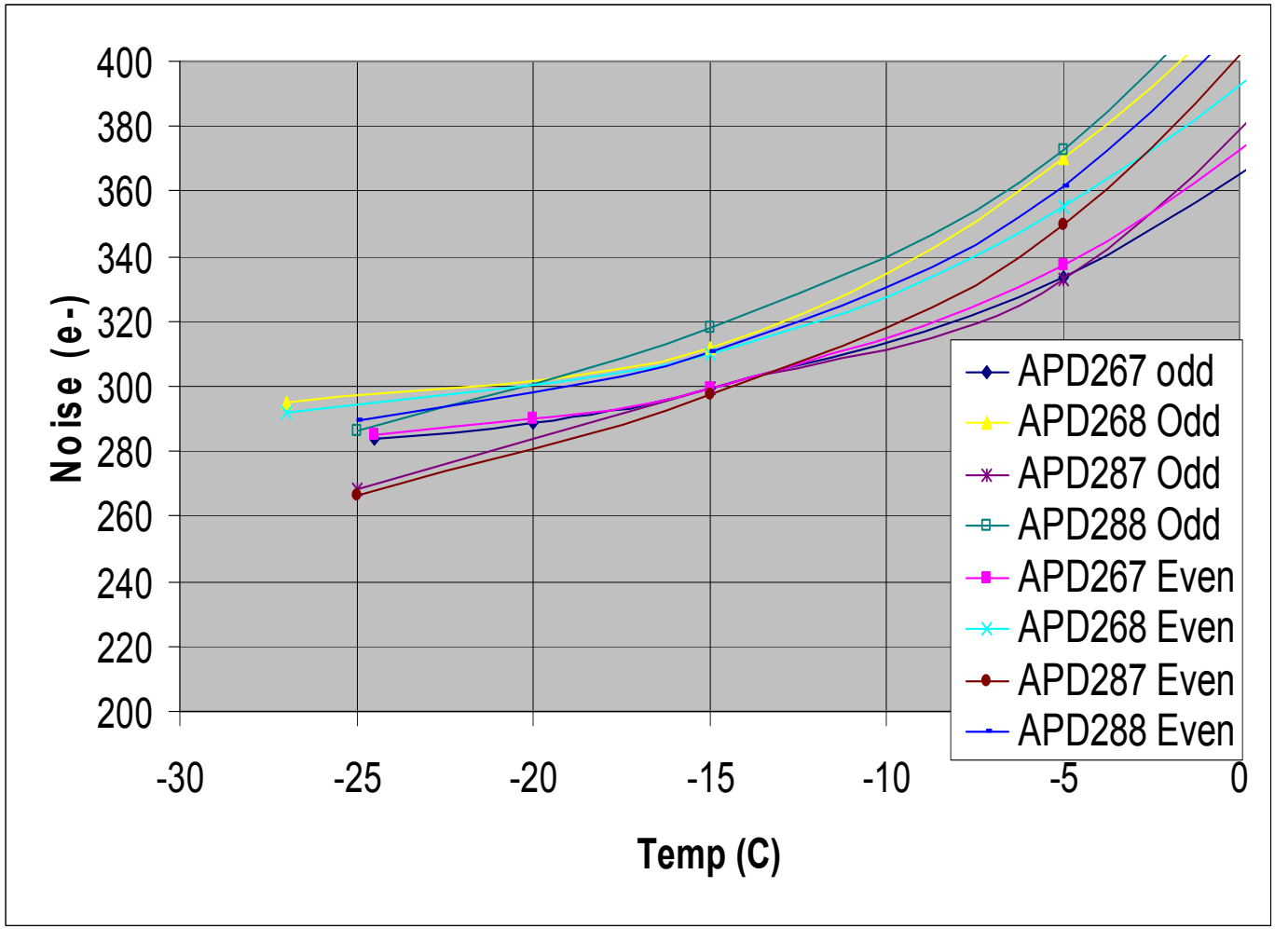
Noise = 310e⁻ at
T=-15C
M=100



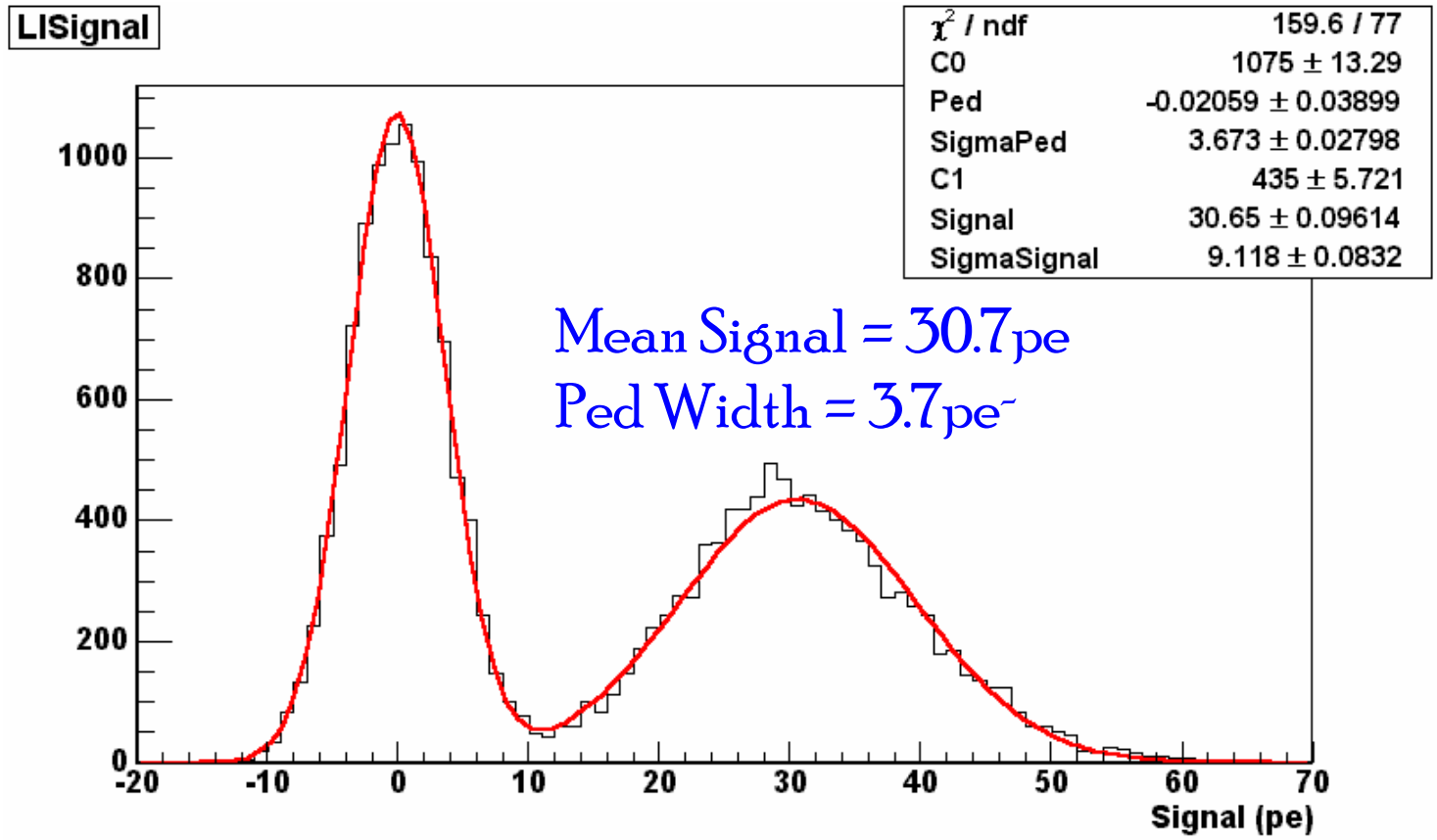
Noise vs. T for 4 new boards (Closer look)

Four boards in use:

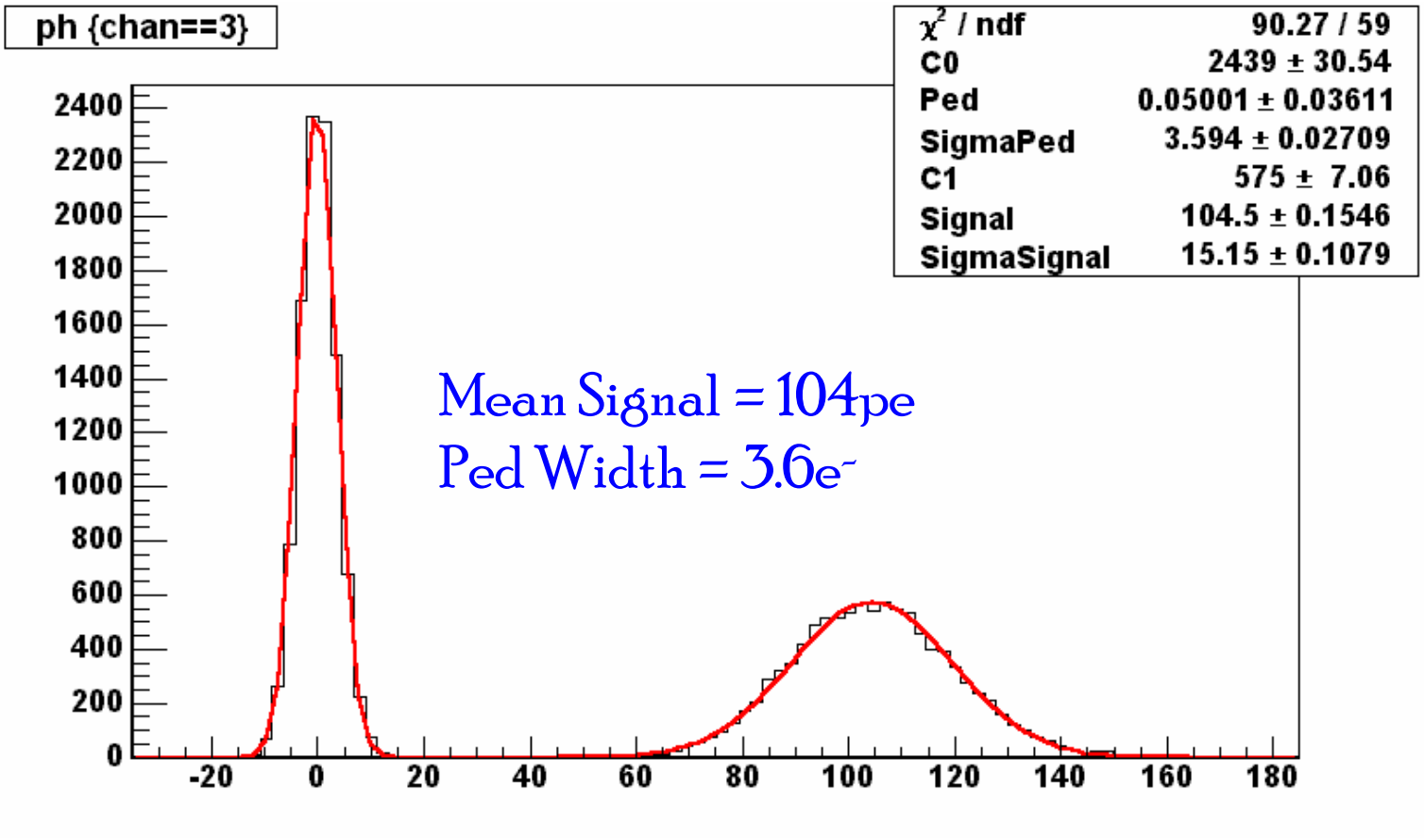
Noise = 310e⁻ at
T=-15C
M=100



Light Injection Signals



Light Injection Signal

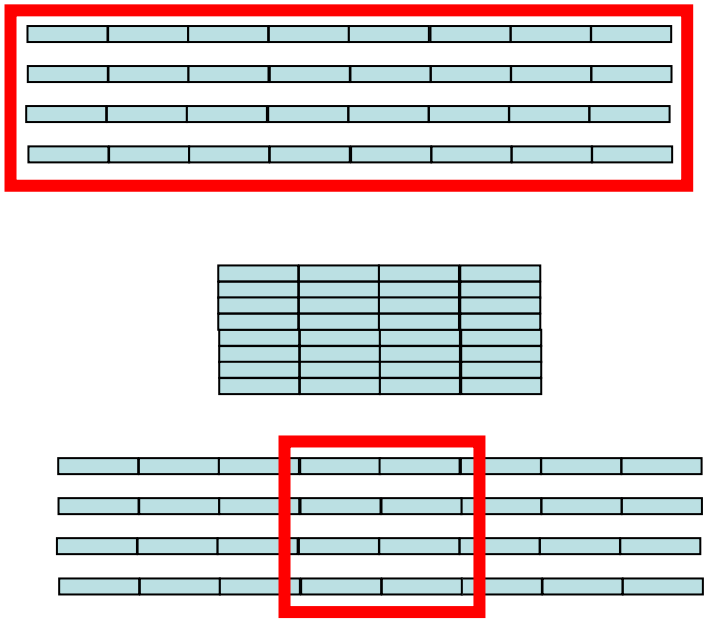


Triggered Scintillator Tracker

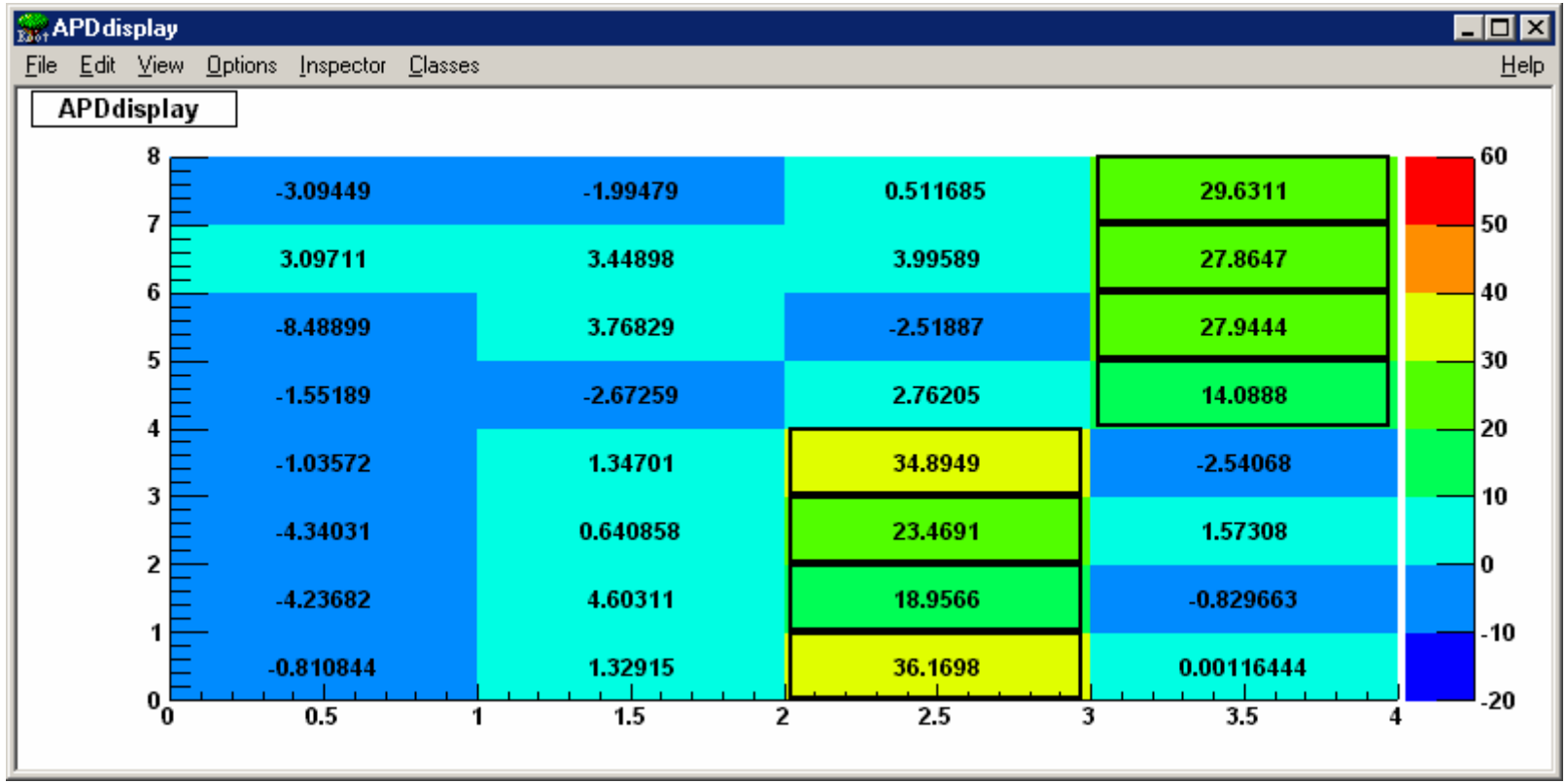
- Provides realistic signals from scintillator/fiber strips
- 2 trigger arrays:
  - 8-wide x 4-thick with
  - standard PMT readout
  - NIM logic generates coincidences
- 1 scintillator test array:
  - 4-wide x 8 thick
  - APD readout

Triggered Mode Signals
Search for Tracks

- Use entire upper trigger array.
- Use 2 columns of lower trigger array.
- Generate coincidence gate from PMT signals and the usual NIM Discriminator and logic modules.

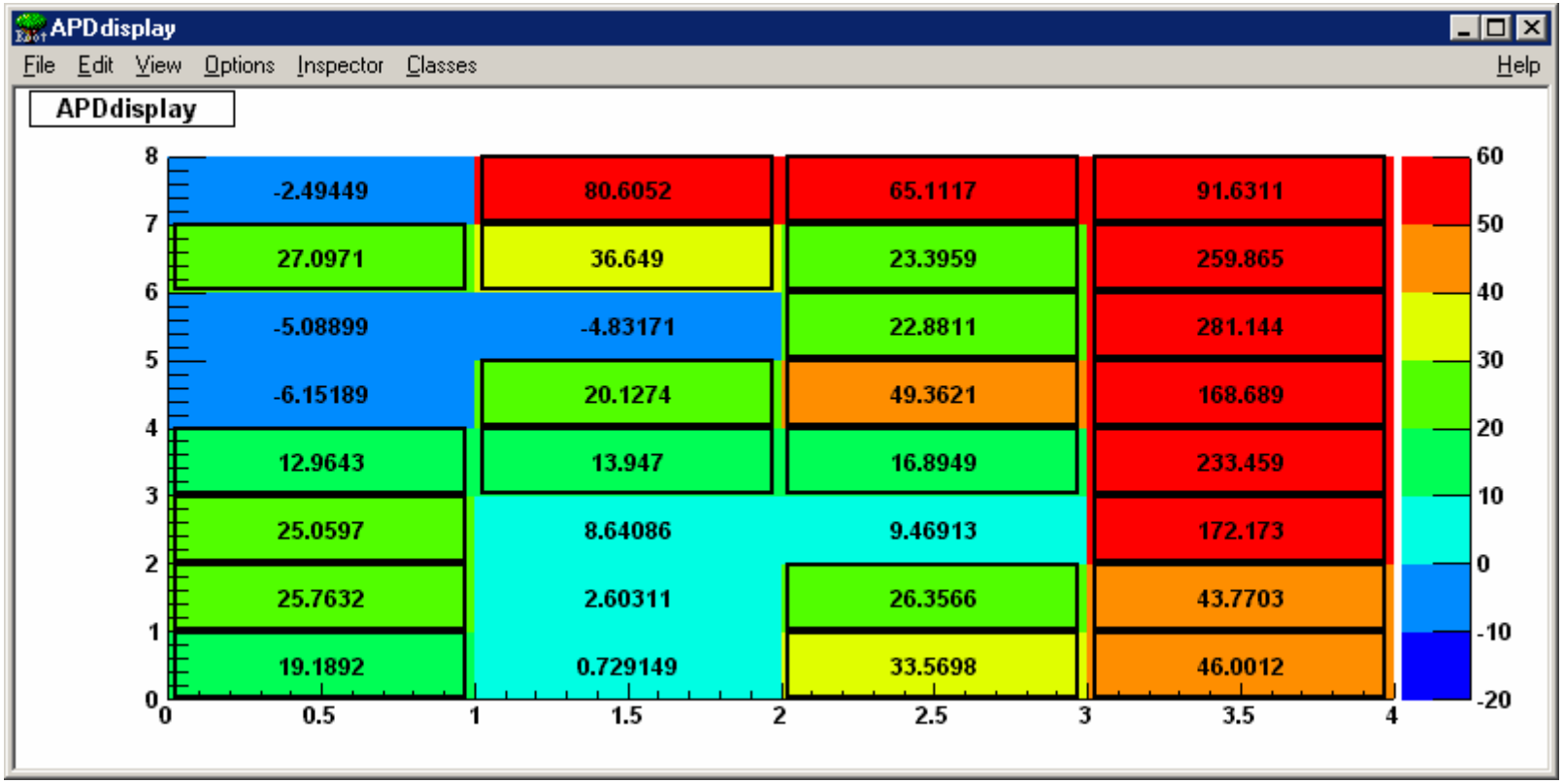


Track from APD287



Shower with APD287

1600 pe total, ~80 MIPS, 150MeV



Status Summary

- Several Working APD readout prototype boards
- 1 working board at UMN
- Currently 3 “in the wild”
  - 2 at IU, 1 at Caltech
- APD cooler boxes coming for these boards, O(weeks)
- More APDs on hand
- Waiting on MASDAs for rest of the prototype boards.